A number of instances are given of the value of mathematical research, and a plea is made for greater encouragement for mathematicians and more serious work in higher education. For example, as Prof. Bryan points out, "Before the mathematical theory of stability had been developed many ships were sunk and many lives lost which could have been saved if the problem had been properly placed in the hands of the mathematician. It was only after these losses took place that the theory of the metacentre was finally evolved, and the problem of stability was reduced to one of pure arithmetical calculation. If one-tenth of the money expended in building these ill-fated ships had been offered to a really competent mathematician possessing the highest knowledge of his subject, to enable him to devote his whole time for a year or so to this particular problem, the saving to the community would have been immense. Yet a similar drama may be enacted at the present day in connection with artificial flight, for while the mathematical theory of stability has been outlined there is a great deal of work to be done before the results can be reduced to simple practical rules."

A FORM of cadmium cell suitable for supplying a small current much more constant than can be obtained from a storage cell is described by Mr. G. A. Hulett, of Princeton, in the July number of the *Physical Review*. A wide-necked bottle of about 8 cm. diameter contains a layer of mercury half a centimetre thick covered to a depth of 4 cm. or 5 cm. by a solution of 10 c.c. of strong sulphuric acid and 800 grams of cadmium sulphate crystals per litre of water. A glass tray about 4 cm. diameter and 4 mm. deep is supported in the solution a little above the surface of the mercury, and contains the 12½ per cent. cadmium amalgam. Contact is made with the mercury and the amalgam by means of wires enclosed in tubes. The mercurous sulphate is prepared in the cell by sending a current through the cell from the mercury to the amalgam, the solution being kept well stirred during the process. The internal resistance of such a cell is about 6 ohms, and it is capable of giving a current of 0·00001 ampere for many days without its electromotive force varying appreciably. A larger cell has been used to give a constant current of 0·04 ampere for a long period for bolometrical work.

IN the case of the majority of the ions Prof. Arrhenius's assumption that the mobility is independent of the concentration holds good through a considerable range of dilute solutions, though variations occurring in stronger solutions are well known, and have been investigated by Jahn, by Bousfield, and by others. The hydrogen ion appears, however, to be an exception. For some years doubt has existed as to the correct value for its mobility, transference experiments at moderate dilutions having given a value 330, considerably higher than the value 315 deduced from conductivity measurements at extreme dilutions. This discrepancy has been traced by Noyes and Kato, who describe their observations in a recent number of the Journal of the American Chemical Society, to variations in the mobility of the hydrogen ion occurring at dilutions much greater than those at which the mobilities of the other ions become constant. Concordant values were obtained from independent observations with hydrochloric and nitric acids, and the evidence for the reality of the variations of mobility appears to be complete. The numbers given in the following table show the magnitude of the changes involved:—

Concentration	HNO_3	0·058	0·0184	0·0067	0·0022	0
	HCl	0·051	0·0170	0·0056	0·0021	0
Mobility ...	HNO_3	350·3	340·2	339·1	332·2	324·6
	HCl	344·2	340·5	341·4	331·8	324·0

THE Harben lectures of the Royal Institute of Public Health, delivered by Prof. Paul Ehrlich last year upon the subject of "Experimental Researches on Specific Therapeutics," have been published by Mr. H. K. Lewis, Gower Street, in the form of a small volume, having a portrait of the lecturer as a frontispiece. The price of the volume is 2*s*. 6*d*. net.

FOR the third year in succession the Library Association has published its "Class List of Best Books and Annual of Bibliography." The work is a classified and annotated catalogue of important works which appeared in the year ended on June 30. The previous year's issue comprised 1800 titles; this year the number has risen to more than 2500. The publication should be useful both to the general reader and the student as a guide to recent literature of noteworthy value.

THE third edition of Prof. H. Snyder's "Soils and Fertilisers" has just been published by the Macmillan Co., New York. The second edition was reviewed in NATURE of January 18, 1906 (vol. lxxiii., p. 266); and though the work has been enlarged and revised, no further description of its contents is necessary. It is sufficient here to say that the book presents in a concise form the scientific principles involved in the successful treatment of the soil and the production of crops.

OUR ASTRONOMICAL COLUMN.

THE ORIGIN OF THE RECENTLY DISCOVERED JOVIAN SATELLITES.—Criticising Prof. Forbes's recent suggestion (NATURE, p. 30, No. 2011, May 14) that the newly discovered eighth satellite of Jupiter may in reality be the long-lost Lexell's comet of 1770, captured by the giant planet in 1779, Prof. Tarrida del Marmol conjectures that a more likely explanation of the origin of the sixth, seventh, and eighth satellites is to be found in the suggestion that they are asteroids which revolved at the same distance from the sun as Jupiter, and were captured by the latter. He shows that if the asteroid be either further away from, or nearer to, the sun, the annexation cannot take place, but when the distances are equal the asteroid will, with its relatively negligible mass, be effectively the inferior planet, and will suffer capture. The recent discovery of the four Jovian asteroids Achilles, Patroclus, Hector, and 1908 C.S., strengthens the possibility of this conjecture. Prof. del Marmol concludes his note, which appears in the August number of *Knowledge and Illustrated Scientific News* (vol. v., No. 8, p. 185), with the tentative suggestion that the Saturnian satellites Hyperion, Themis, and Phœbe may have been captured by Saturn in the same manner.

In answer to our inquiries concerning the above suggestions, Mr. Melotte, the discoverer of Jupiter's eighth satellite, points out that the images found on the plates give no indication whatever of diffuseness, such as might be expected from a cometary body, but are in every respect similar to the photographed images of the other faint satellites. According to Hind, Lexell's comet, when nearest the earth, exhibited a white nebulosity surrounding the nucleus and subtending an angle of 2° 23′, although no tail was visible. Mr. Melotte also suggests that others of the major planets may be attended by satellites hitherto undiscovered by reason of their faintness, and that the motions of these may subsequently be found to be retrograde, thus reducing the importance of the anomalies which have hitherto puzzled astronomers in considering the origin of the satellites under discussion. In conclusion, he adds that possibly Prof. del Marmol intended to write Japetus in place of Themis, as, so far as is known, the latter rarely reaches a distance of 220″ from Saturn.

ELEMENTS OF THE ORBIT OF JUPITER'S EIGHTH SATELLITE.—Circular No. 102 from the Kiel Centralstelle contains the following equatorial elements for the orbit of Jupiter's eighth satellite, computed by Messrs. Crawford and Meyer

and communicated telegraphically by Prof. E. C. Pickering:—

T = 1908 August 25·72
ω = 51° 9′
Ω = 236° 12′ } 1908·0
i = 145° 48′
q = 0·103
e = 0·4395
Period = 2^a·55.

Osculation, 1908 March 8, 19h. 45·5m. G.M.T.

SEARCH-EPHEMERIDES FOR COMET TEMPEL$_3$-SWIFT.—Three ephemerides for the comet discovered by Tempel in 1869, and recognised as periodical by Swift in 1880, are published by M. E. Maubant in No. 4269 of the *Astronomische Nachrichten* (p. 349, August 14). These ephemerides give the positions of the comet from August 29 to November 1, the times of perihelion being taken as September 22·88, September 30·88, and October 8·88 respectively. The following is an extract from the ephemeris for the mean date:—

Ephemeris (12*h*. *M.T. Paris*).

1908	α h. m.	δ ° ′	log *r*	log Δ
Aug. 29	4 18·8	+30 39·0	0·0879	9·8615
Sept. 2	4 40·0	+31 27·9	0·0822	9·8542
,, 6	5 1·5	+32 3·5	0·0771	9·8484
,, 10	5 23·0	+32 25·4	0·0727	9·8440
,, 14	5 44·3	+32 33·5	0·0689	9·8409

From this ephemeris it is seen that the comet is travelling eastwards through Taurus to Auriga, and may be discovered during the early morning before dawn. Its period is about 5½ years, and it was well observed in 1891, although at its more recent returns in 1897 and 1903 it was not seen. On September 9 the comet should be about 4° N. of β Tauri, which rises about 10 p.m.

DEFINITIVE ORBIT OF COMET 1826 V.—No. 4269 of the *Astronomische Nachrichten* (p. 341, August 14) contains a discussion, by Herr A. Hnatek, of Vienna, of the orbit of comet 1826 V, from which the author deduces that the orbit was parabolic, the most probable ellipse giving a period of nearly 28,000 years. Herr Hnatek directs attention to the fact that in the early hours of November 18, 1826, the comet grazed the sun.

RELATIVE DEPTHS OF THE SUN-SPOTS OF A GROUP.—Discussing stereocomparator measures which he has made on photographs taken at Greenwich on July 4, 5, and 6, Prof. Wilhelm Krebs, in No. 4267 of the *Astronomische Nachrichten* (p. 315, August 7), shows that the different spots of the group which was then near the central meridian were at different levels, and also that the changes of level varied from spot to spot during the intervals between the taking of the photographs. Whilst the most easterly spot showed a sharp increase of height above the datum line, the most westerly exhibited a sharp fall. The different heights, measured in 1000 km., varied from 137 to −3, whilst the general increase in height during the two intervals amounted to 17,000 km., or 27 per cent.

AN ALLEGED EXCRETION OF TOXIC SUBSTANCES BY PLANT ROOTS.[1]

THE idea formulated a century ago by de Candolle that plant roots excrete toxic substances has recently been very much pushed forward by the American Bureau of Soils to explain the effects of fertilisers and the advantage of a rotation of crops. The American method of experiment is to grow seedlings in water culture for a few days and measure the amount of transpiration, which is considered to be an index of the amount of growth. The seedlings are then removed and replaced by a second batch, without changing the water; the rate of transpiration is found to be diminished, showing (it is stated) that a toxic body excreted by the roots of the first batch is adversely affecting the second. Further, seedlings grown in an aqueous extract of certain poor soils are found to transpire less water than others grown in distilled water, and it is concluded that these soils contain some toxic material, presumably excreted by plants. The toxic body is, however, precipitated on addition of charcoal, ferric hydrate, and solutions of various manures; and the Bureau of Soils argues that the function of fertilisers, in some cases at any rate, is not to feed the plant, but to precipitate the toxin excreted by previous plants. Rotations of crops are of advantage, because the toxin excreted by one plant is not necessarily harmful to plants of a different order.

It cannot be said that any very convincing evidence is offered in support of this view. The assumption that transpiration is a measure of plant growth is not borne out by any of the figures quoted; thus in a series of experiments given in Bulletin No. 36 the crop weights and transpiration results are:—

Experiment	1	2	3	4	5	6	7	8	9
Transpiration	100	126	116	107	116	133	119	147	111
Crop weight	100	108	95	100	103	112	107	129	108

Another weak point is that the experiments are made with seedlings, and last only a few days, instead of being carried on to the end of the plant's life. The nutrition of the seedling is not the same as that of the plant, and even if it were demonstrated that secretion from seedling roots took place, it would not follow that there was a similar secretion from the roots of fully grown plants.

In the last Bulletin from the Soil Bureau (No. 48) an account is given of more than 13,000 pot trials with soils from different parts of the United States. The results show, as might be expected, that addition of manures increases the crop, and that each manurial substance exerts a specific effect which is not shown by any other; with this statement everyone would agree. The further conclusion is drawn that the character of fertiliser required depends more upon local conditions and practices than on the type of soil or the geological formation to which it belongs, so that the fertilisers required for the same type of soil as it occurs in different localities usually vary more than those required for very different types when in the same locality and subjected to similar environment. If this generalisation turned out to be true, it would be more easy to reconcile with the plant excretion view than with the nutrition view of the function of fertilisers, but an examination of the tables does not show that there is any proof. Averages are taken without any regard to their probable value. Thus in one section of the table we find three soils only, and they give the following percentage increases when treated with various manures, yet the author finds no difficulty in taking an average:—

Soil	Percentage increase given by manures supplying: Potash	Phosphoric acid	Lime
Cecil sand	−8	−15	8
Cecil sandy loam	3	40	33
Iredell clay loam	6	0	3
Average	0	8	15

The magnitude of the experimental error can only be inferred from one table, where the separate crop weights for twenty pots are given; it would appear to be considerable, since the weights vary from 58·7 grams to 89·9 grams; but the author groups the pots in sets of five, and in this way reduces the error to 5 per cent., which is given as the probable error for all the experiments! There

[1] (*a*) "Fertility of Soils as affected by Manures." By Frank D. Gardner. (U.S. Department of Agriculture, Bulletin No. 48.)
(*b*) "Note on a Toxic Substance Excreted by the Roots of Plants."[2] By F. Fletcher. (Memoirs of the Department of Agriculture in India, vol. ii., No. 3.)
(*c*) "Crop Rotation and Soil Exhaustion." By F. Fletcher. (Cairo Scientific Journal, vol. ii., No. 19.)